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Conversion processes for high-viscosity heavy crude oil in catalytic and noncatalytic aquathermolysis

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Abstract

© 2014 Springer Science+Business Media. We have conducted experiments on noncatalytic and catalytic aquathermolysis of high-viscosity heavy crude oil from the Ashal'cha field (Tatarstan) in the presence of a crude oil-soluble nickel- and cobalt-containing catalyst, a proton donor, and a rock-forming mineral. We have identified the characteristic features of the change in the constituent composition, the hydrocarbon composition, and the fractional composition, the rheological properties of the crude oils, the average molecular weight of the asphaltenes for catalytic and noncatalytic conversion processes. For catalytic aquathermolysis, we established significant de novo formation of light 70°C-250°C fractions (by 23 wt.%), n-alkylbenzenes, an increase in the oil content by a factor of 1.3, a decrease in the resin content by a factor of 1.7, and a decrease in the viscosity by 98 rel.%. The major difference between the conversion of crude oil in the presence of the catalyst and the proton donor involves activation of degradation reactions at C-C, C-N, C-O, C-S bonds and blocking of polymerization reactions and accordingly less coke formation. We observed sorption of the catalyst components on rock.

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Keywords

aquathermolysis, crude oil-soluble catalyst, proton donor, rock-forming mineral